CLAIMS

1. A measuring device for investigating particles (3) which are suspended in a carrier liquid, comprising two or more measuring electrodes (12.1-12.4) for carrying out electrical measuring of the particles (3), **characterised by** a trapping element for fixing the particles (3) for electrical measuring.

2. The measuring device according to claim 1, **characterised in that** the trapping element is a field cage (4) or a laser tweezer (22).

3. The measuring device according to claim 2, **characterised in that** the field cage (4) comprises several cage electrodes (2.1-2.8), wherein at least one of the cage electrodes (2.1-2.8) is also a measuring electrode.

4. The measuring device according to claim 2 or 3, **characterised in that** an electrical trapping signal for fixing the particles (3) is present at the cage electrodes (2.1-2.8), and an electrical measuring signal is present at the measuring electrodes,

5. The measuring device according to claim 4, **characterized in that** the frequency of the trapping signal is different from that of the measuring signal, and wherein the trapping signal is present before, during, or after the measuring signal.

6. The measuring device according to claim 2, **characterised in that** the field cage (4) comprises several cage electrodes (2.1-2.8), wherein the measuring electrodes (12.1-12.4) are galvanically separated from the cage electrodes (2.1-2.8) and can be selected independently of each other.

7. The measuring device according to any one of the preceding claims, **characterised in that** the measuring electrodes (12.1-12.4) comprise at least two electrodes (12.2, 12.4) for supplying current, and at least two electrodes (12.1, 12.3) for measuring the voltage.

8. The measuring device according to any one of the claims 1 to 5, **characterised in that** the measuring electrodes (12.1-12.4) comprise two electrodes (12.2, 12.4) for supplying current and measuring the voltage.

9. The measuring device according to anyone of the claims 1 to 7, **characterised in that** the measuring electrodes comprise two electrodes (e.g. 12.2 and 12.4 or two of the cage electrodes 2.1-2.8) for supplying current and a third electrode (e.g. either 12.1 or 12.3) that uses any one of the other measuring electrodes (i.e. 12.2 or 12.4) or remaining cage electrodes (2.1-2.8) as a reference electrode for measuring voltage.

10. The measuring device according to anyone of the preceding claims, **characterised in that** the measuring electrodes comprise two electrodes (e.g. 12.2 and 12.4 or two of the cage electrodes 2.1-2.8) for supplying current and two electrodes (e.g. 12.1 and 12.3) for measuring voltage.

11. The measuring device according to anyone of the preceding claims, **characterised in that** the measuring electrodes comprise two or more electrodes for supplying current and/or two or more electrodes for measuring voltages.

12. The measuring device according to anyone of claims 7 to 11, **characterised in that** the electrodes (12.1, 12.3) which are used for measuring the voltage(s) and/or other

electrode(s) are arranged in relation to the cage electrodes (2.1-2.8) such that the voltage(s) between the electrodes (12.1, 12.3) used for measuring the voltage(s) and/or other electrodes is not influenced or minimally influenced by the trapping signal present at the cage electrodes (2.1-2.8).

13. The measuring device according to anyone of claims 7 to 12, **characterised in that** the cage electrodes (2.1-2.8) are driven in pairs in phase opposition, wherein at least one of the measuring electrodes (e.g. 12.1, 12.3) is arranged in a plane which extends between two cage electrodes (2.1-2.8) which are driven in phase opposition.

14. The measuring device according to any one of the preceding claims, **characterised in that** the measuring electrodes (e.g. 12.1-12.4) are arranged in a measuring plane.

15. The measuring device according to claim 14, **characterised in that** the measuring plane(s) of the measuring electrodes (12.1-12.4) is essentially aligned at an angle in relation to the direction of the flow of the carrier liquid.

16. The measuring device according to claim 14, **characterised in that** the measuring plane(s) of the measuring electrodes (e.g. 12.1-12.4) is aligned essentially parallel in relation to the direction of flow of the carrier liquid.

17. The measuring device according to any one of the preceding claims, **characterised in that** a current path extends between a pair of measuring electrodes (e.g. 12.1-12.4), and a voltage measuring path extends between another pair of measuring electrodes (e.g. 12.1-12.4), wherein the voltage measuring path extends across the current path.

18. The measuring device according to claim 17, **characterised in that** the current path and the voltage measuring path essentially extend through the field cage (4).

19. The measuring device according to any one of the preceding claims, **characterised in that** electrical measuring comprises impedance measuring.

20. The measuring device according to claim 19, **characterised in that** electrical measuring comprises impedance spectroscopy measuring or impedance measurements at a plurality of frequencies.

21. The measuring device according to any of the preceding claims, **characterised in that** electrical measuring comprises impedance measuring.

22. The measuring device according to any of the preceding claims, **characterised in that** electrical measuring comprises impedance spectroscopy measuring.

23. The measuring device according to any of the preceding claims, **characterised in that** electrical measuring comprises impedance tomography measuring.

24. The measuring device according to any one of the preceding claims, **characterised in that** the field cage (4) is a dielectrophoretic or an electrophoretic field cage (4).

25. The measuring device according to any one of the preceding claims, **characterised in that** the field cage (4) comprises eight cage electrodes (2.1-2.8) which are arranged at the corner points of a right parallel epiped.

26. The measuring device according to claim 25, **characterised in that** the right parallel epiped comprises an essentially horizontal bottom base area, wherein the cage electrodes (2.1-2.8) form the measuring electrodes at the four corner points of this base area.

27. The measuring device according to any one of claims 1 to 24, **characterised in that** the field cage (4) comprises five cage electrodes (2.1-2.5), one each at each corner point of a pyramid.

28. The measuring device according to claim 27, **characterised in that** the pyramid comprises a bottom base area, wherein the cage electrodes (2.1-2.5) form the measuring electrodes at the four corner points of this base area.

29. The measuring device according to any one of the preceding claims, **characterised in that** the cage electrodes (2.1-2.8) are connected to a control circuit (6) which selects the cage electrodes (2.1-2.8) with the trapping signal.

30. The measuring device according to any one of the preceding claims, **characterised in that** the measuring electrodes (12.1-12.4) are connected to a measuring circuit (8).

31. The measuring device according to claims 29 and 30, **characterised in that** the cage electrodes (2.1-2.8) are connected to the measuring circuit (8) and to the control circuit (6) by way of a controllable switchboard section (5), wherein the switchboard section (5) alternately connects the measuring circuit (8) to the measuring electrodes (12.1-12.4), or connects the control circuit (6) to the cage electrodes (2.1-2.8).

32. The measuring device according to any one of the preceding claims, **characterized in that**

a) said carrier liquid is flowing within a channel (15) comprising walls (16, 17);

b) said walls (16, 17) of said channel (15) comprise an electrically insulating inner layer (16.1, 17.1) an and outer layer (16.2, 17.2);

c) at least one of said inner layers (16.1, 17.1) comprises an opening (18) at the place of measurement;

d) at least one of said measuring electrodes (19, 20) is retracted between said inner layer (16.1, 17.1) and said outer layer (16.2, 17.2), so that the edges of the measuring electrodes (19) are exposed to the carrier liquid flowing within said channel (15).

33. The measuring device according to claim 32, **characterized in that** said opening (18) within said inner layer (16.1) has a circular shape.

34. The measuring device according to claim 32 or 33, **characterized in that** said electrode (19) for supplying current has a semi-circular shape.

35. The measuring device according to any one of claims 32 to 34, **characterized in that** said electrode for supplying current is split into several sections (19.1-19.3).

36. The measuring device according to claim 35, **characterized in that** said sections (19.1-19.3) of said electrode for supplying current do not protrude into said opening (18) within said inner layer (16.1).

37. A microfluidic system comprising a measuring device according to any one of the preceding claims.

38. A cell sorter comprising a microfluidic system according to claim 37.

39. A measuring method for investigating particles (3) which are suspended in a carrier liquid, comprising the following steps:

- Carrying out an electrical measuring process on at least one particle (3) by means of two or more measuring electrodes (12.1-12.4)

characterised by the following step:

- Fixing the particle (3) in a trapping element (4) for the measuring process.

40. The measuring method according to claim 39, **characterized in that** said trapping element is a field cage (4) or a laser tweezer (22).

41. The measuring method according to claim 40, **characterised in that** the field cage (4) comprises several cage electrodes (2.1-2.8) and in that several of the cage electrodes (2.1-2.8) form measuring electrodes, wherein a measuring current is supplied by way of at least two of the measuring electrodes, while a measuring voltage is measured by means of at least two of the measuring electrodes.

42. The measuring method according to claim 41, **characterised in that** an electrical trapping signal for fixing the particles (3) is applied to the cage electrodes (2.1-2.8), wherein the frequency of the trapping signal differs from that of the measuring current.

43. The measuring method according to any one of claims 40 to 42, **characterised in that** the field cage (4) comprises several cage electrodes (2.1-2.8), wherein the measuring electrodes (12.1-12.4) are selected separately and independently of the cage electrodes (2.1-2.8).

44. The measuring method according to any one of claims 40 to 43, **characterised in that** the cage electrodes (2.1-2.8) are driven in pairs in phase opposition.

45. The measuring method according to any one of the preceding claims, **characterised in that** electrical measuring comprises impedance measuring.

46. The measuring method according to claim 45, **characterised in that** electrical measuring comprises impedance spectroscopy or tomography measuring.

47. The measuring method according to any one of claims 39 to 46, **characterised by** the following steps:

- Carrying out reference measuring; and
- Comparing the result of reference measuring with the result of electrical measuring of the particle (3).

48. The measuring method according to claim 47, **characterised in that** reference measuring is carried out with an empty field cage (4).

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